# SMD, challenges for hydro-based systems in the Pacific Northwest

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# General Observations

- The Pacific Northwest (PNW) and East Coast power markets have evolved along different paths due in large part to geography and resource mix. The RTO West proposal responds to Order 2000 and deals with the unique needs of Western transmission and generation.
- Can SMD be implemented in the PNW? Technically yes, but resolving cost shifts and political debates will be as challenging as determining technical feasibility.
- Bonneville adds unique considerations being a large Federal PMA (non-jurisdictional) transmission owner.
- **Major challenges**:
  - ✓ preserving functionality of pre-existing agreements to meet the needs of the PNW,
  - ✓ reconciling jurisdiction / governance issues,
  - ✓ sorting out the net effect of cost shifts, and
  - ✓ dealing with the magnitude of change (need for new systems)

# Topology of the PNW

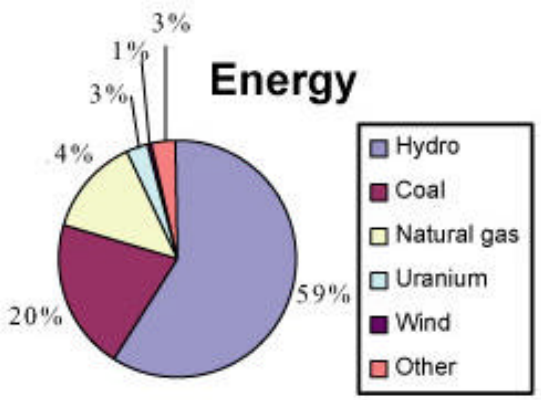
- Large geographic footprint (258,000 square mile river basin)
- Low density of load
- Predominantly interlinked hydro, with base-loaded thermal resources.
- Federal Columbia River Power System (FCRPS) - 31 hydro projects, 1 nuclear plant, and several smaller renewable, contract resources
- Hydro generation output is controlled by regulated water storage releases (shared fuel supply used for power and non-power purposes).

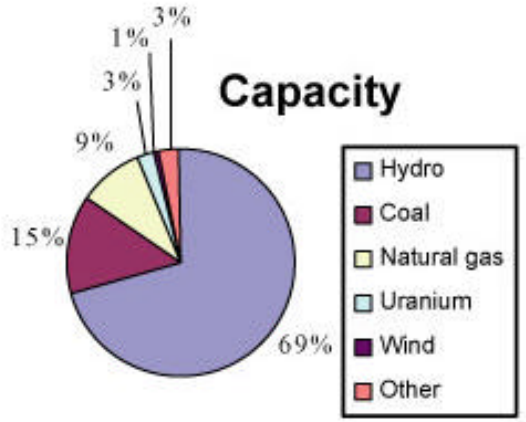
# Pacific Northwest Generating Projects

(as reported by the Northwest Power Planning Council on June 2002)

| Resource | Energy | | Capacity | | Capacity in % of energy |
|---|---|---|---|---|---|
| | MWs | % of total | MWs | % of total | |
| Hydro | 16,132 | 59% | 33,473 | 70% | 107% |
| Coal | 5,598 | 20% | 6,992 | 15% | 25% |
| Natural gas | 3,870 | 14% | 4,351 | 9% | 12% |
| Uranium | 851 | 3% | 1,216 | 3% | 43% |
| Wind | 161 | 1% | 474 | 1% | 195% |
| Other | 821 | 3% | 1,291 | 3% | 57% |
| **Total** | **27,434** | | **47,797** | | |

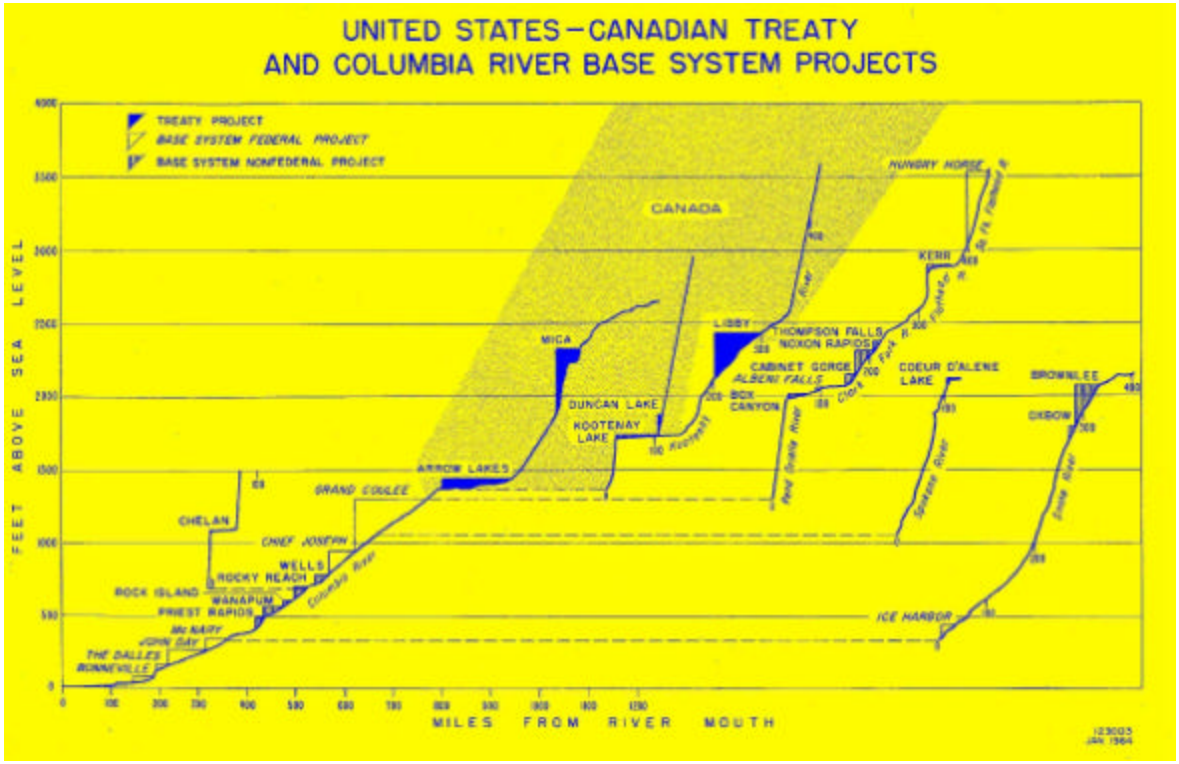
(NOTE - This is the amount that capacity exceeds energy, expressed in terms of percent of energy)



# PNW Hydro Characteristics

- Common fuel supply, affected by non-power constraints
- Hydro operations have consequence, either immediately or in the future
- Hydro is used for regulation and load-following while thermal tends to be base loaded



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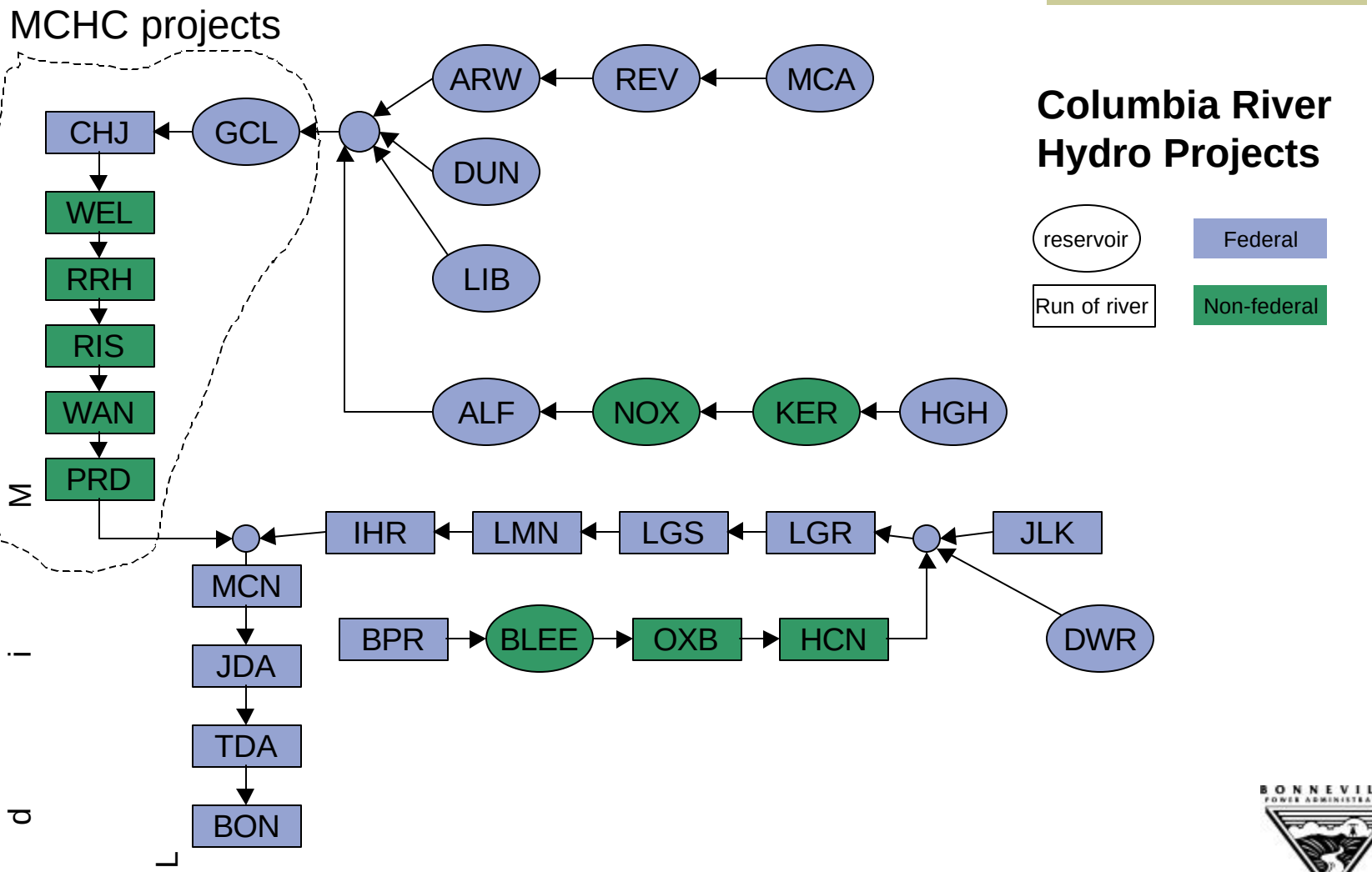

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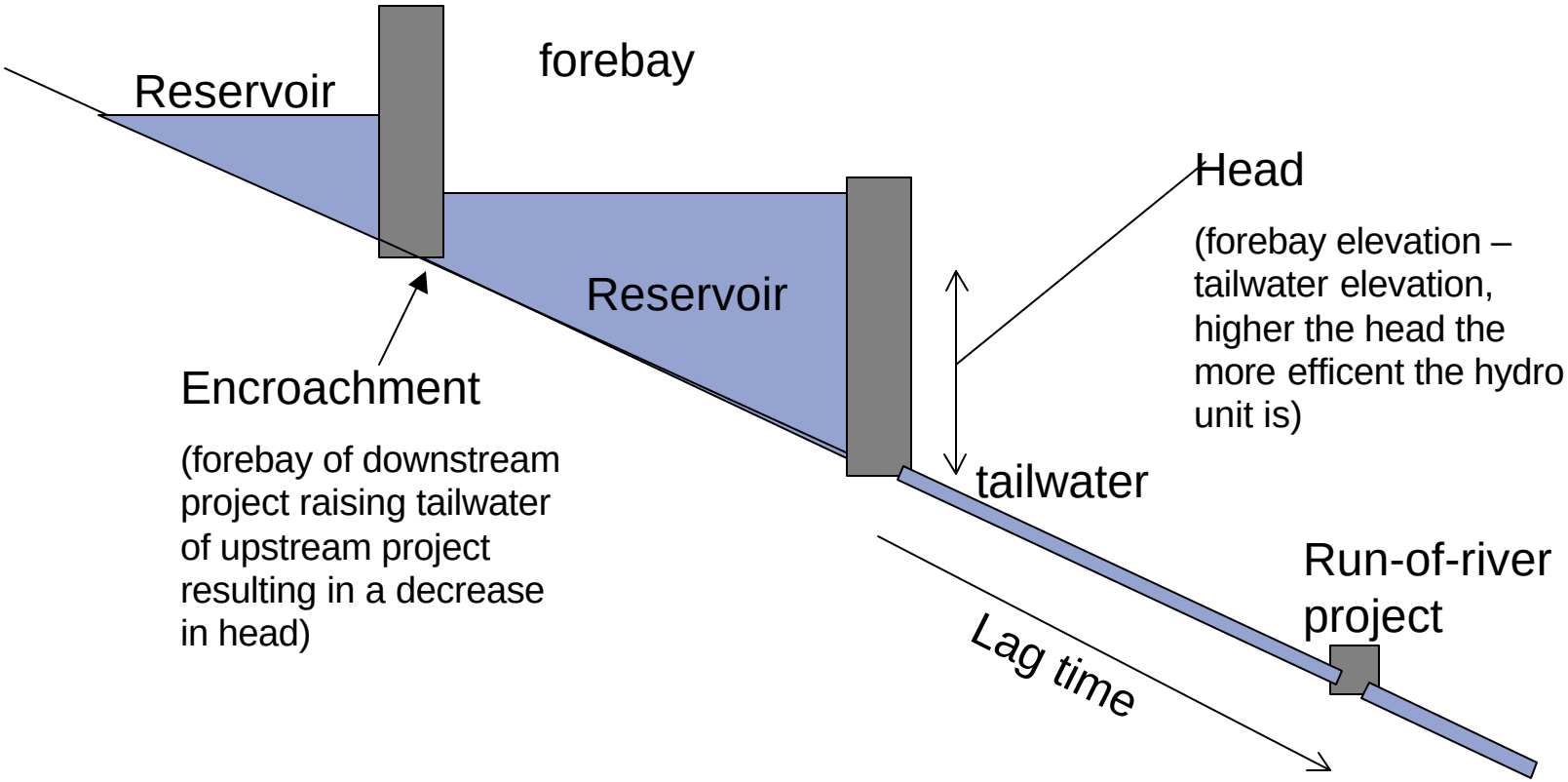
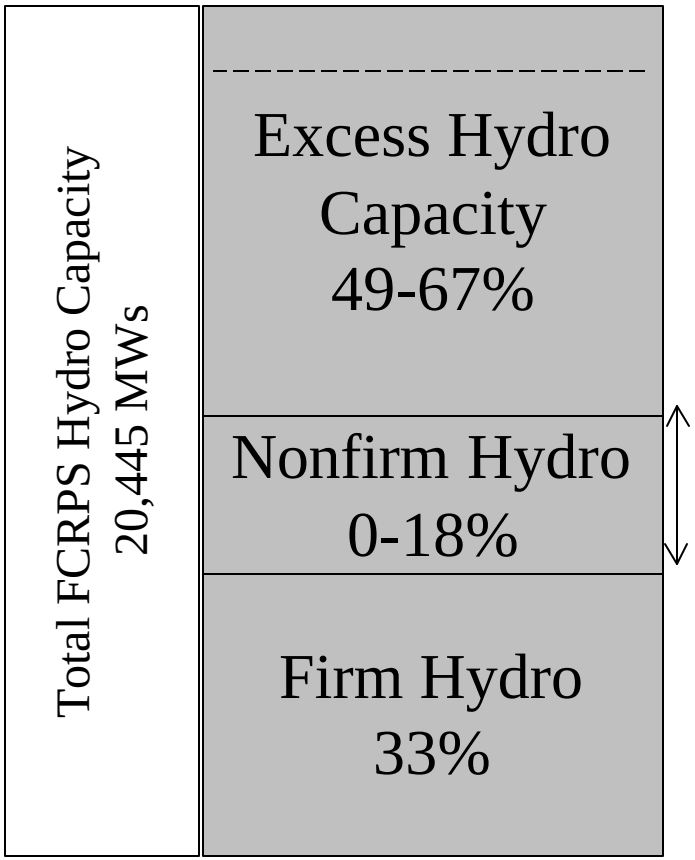


# BPA's Hydro Characteristics

- Annual generation ranges from 33 to 51% of capacity.
- Size of FCRPS projects range from nearly 7,000 MW at Grand Coulee to 1,500 kW Boise Diversion
- BPA does not own resources, must coordinate with Corps, Reclamation, Energy Northwest & others
- Energy constrained - capacity values are not sustainable for long periods

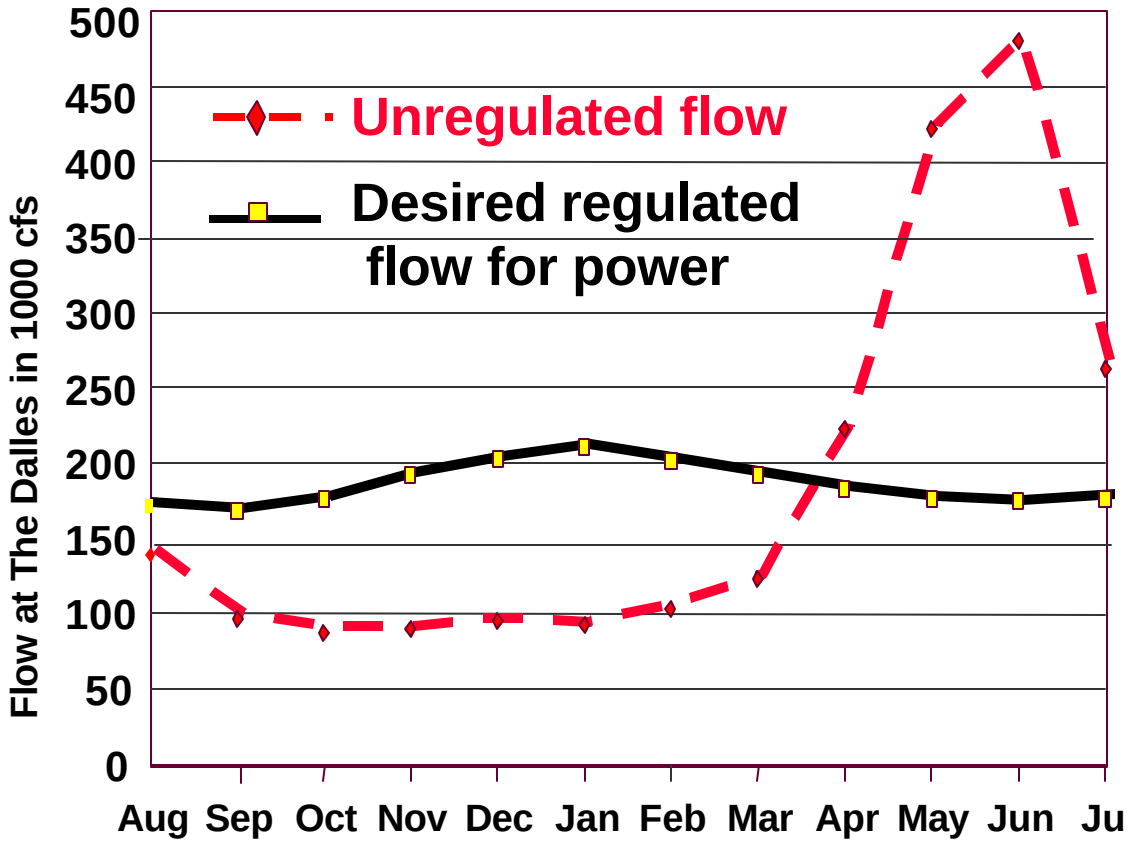


# BPA's Hydro Characteristics

- Average runoff 106 million acre feet Jan-Jul (ranges from 50 to 150 MAF)
- **STORAGE LIMITED SYSTEM** (useable storage down to 5 MAF in US and 15.5 MAF in Canada)
- When Federal PNW reservoirs are empty BPA can store approximately 25% of the annual runoff in reservoirs.
- The Colorado or Missouri systems can store 400% of the annual runoff

# BPA's Hydro Characteristics

- **Reservoir storage** converts spill, nonfirm, and unusable energy to firm energy and usable nonfirm energy.



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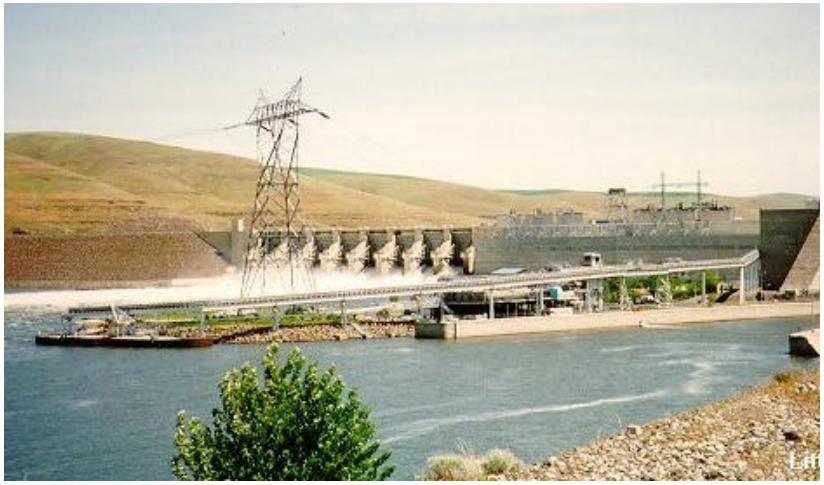

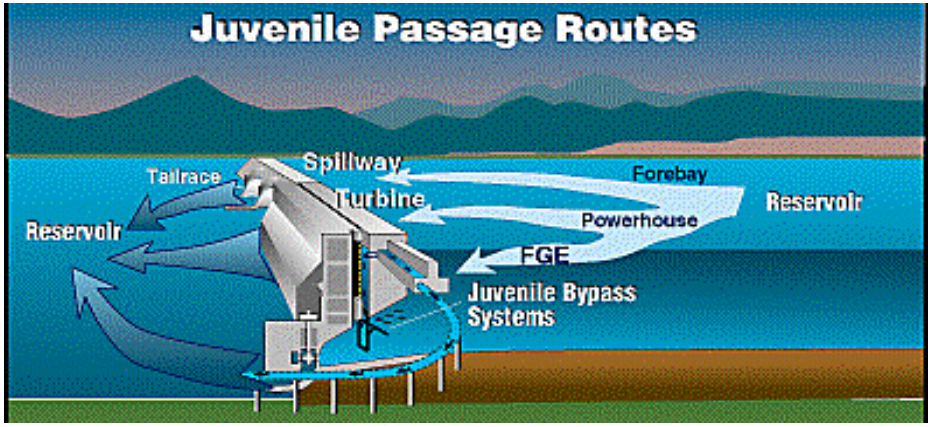


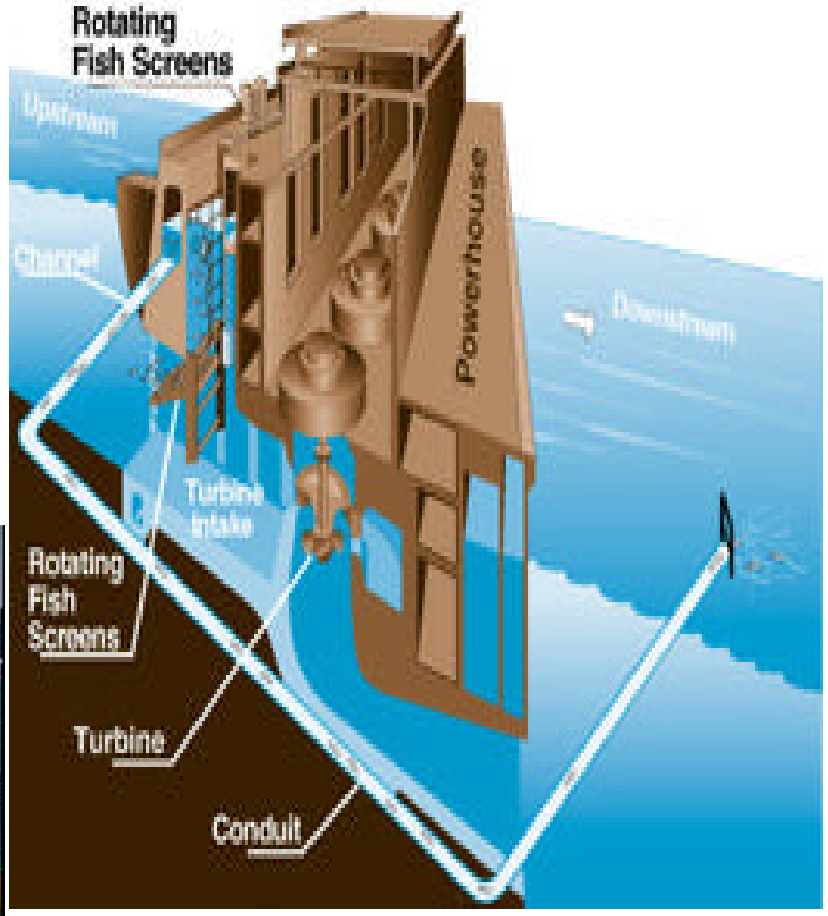

# The Need for Resource Coordination in the PNW

- Agreements - Columbia River Treaty, PNCA, MCHC
- Coordination creates certainty for a variable resource (like hydro), maximizes generation output of limited fuel, and helps “shape” resources to meet load.
- Provides participants with protection from changes to anticipated upstream storage releases.
- Columbia River Treaty (with Canada) assumes that PNW resources are coordinated.

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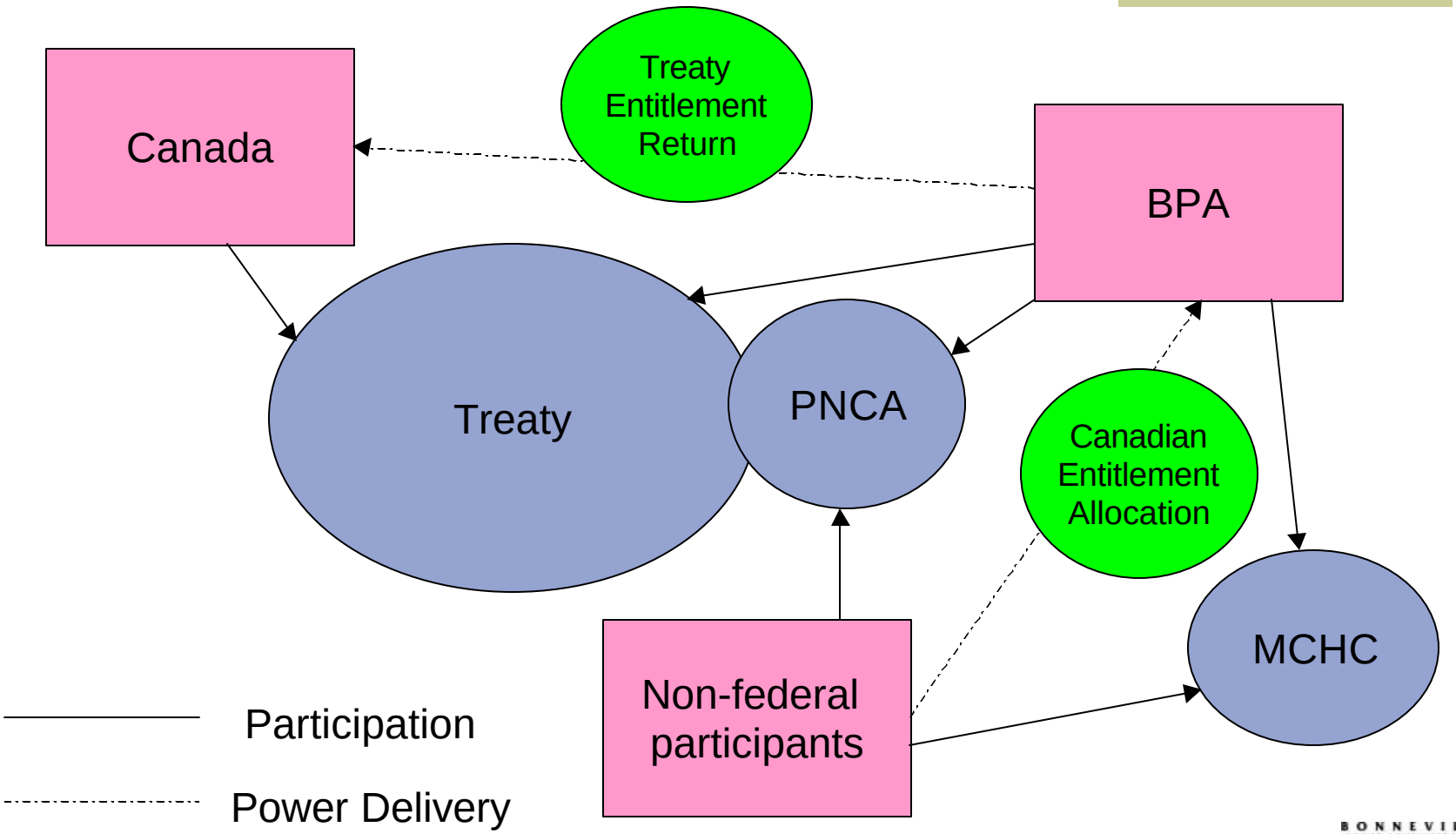

# The Need for Resource Coordination in the PNW

- Columbia River Treaty
  - ✓ Canada built three large storage reservoirs in SE British Columbia. The US built Libby Dam in Montana; its reservoir extends into Canada
  - ✓ Storage increased by 15.5 MAF resulting in US power benefits that are approximately 2400 MW (capacity) and 9.2 TWh (energy) of the system's annual production.
  - ✓ Treaty's focus is on coordinated operations for flood control and power purposes.
  - ✓ The US is obligated to return ½ the benefits to Canada (1200 MW capacity and 4.6 TWh annual energy) of which 27.5% is produced at non-federal hydro projects (Mid-C).

# The Need for Resource Coordination in the PNW

- Drivers that set the stage for coordination
  - ✓ Uncertainty of hydro generation availability.
  - ✓ Effects of being hydraulically interconnected created potential for inefficient hydro operations (spill) and loss of control over hydro generation.
  - ✓ Needed support of PNW to get the Columbia River Treaty in place.
  - ✓ Columbia River Treaty established an obligation to deliver half of the US power benefits that would be realized if coordination exists within the US.

# The Need for Resource Coordination in the PNW

- Basic assumptions of PNW coordination agreements:
  - ✓ One utility principle – determine the optimum power operation within the bounds of non power constraints as if operated by a single entity.
  - ✓ Power optimized on a monthly basis by directing the amount and timing of storage releases at specific reservoirs.
  - ✓ Coordination will be safe for all parties (voluntary, changes allowed only if agreed to by all coordination parties).
  - ✓ Recognize autonomy of owners to operate their resources for their own needs while providing certainty to other coordinated parties (using obligations for energy exchanges based on theoretical optimum hydro operation).
  - ✓ Power benefits are independent of location (parties bring sufficient transmission capacity to make coordination work).

# The Need for Resource Coordination in the PNW

- What coordination provides to PNW parties:
  - ✓ Captures benefits of diversity between hydro and thermal resources and diversity of load in a way that all benefit.
  - ✓ Coordinated power planning.
  - ✓ Provides a forum for owners/operators to coordinate operations and resolve problems in a collaborative manner.
  - ✓ Provides certainty that US power benefits contemplated under the Columbia River Treaty can be realized.

# How the PNW responded to Orders 888 & 2000

- Preferred approach - use collaborative process developing voluntary agreements to achieve objectives.
  - ✓ Solves statutory & governance problems.
  - ✓ Addresses compatibility problems for critical legacy agreements.
  - ✓ The PNW has a proven track record of voluntary agreements working.
  - ✓ Allows diverse interests to be taken into account in decision-making.

# SMD, Challenges for the PNW

- Technically, PNW hydro operations are allowed under SMD, but at what cost? Can we assure access under all hydro conditions?
- Pre-existing contracts - how to preserve functionality and who pays for it?
- Hydro uncertainty – PNW network Tx rights are broadly define (not precisely defined), CRRs need to be precisely defined Tx rights.
- Cost shifts and cost uncertainty are basic problems.
- It may be impossible to sort out the net effect of all the various cost shifts.